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Evidence presented in this paper indicates the existence of both general intellectual potential and differential abilities of Eskimo and Indian-Metis pupils in contrast to White classmates. A factor analytic technique is described which was used to treat data obtained from a sample of more than 1,800 students. One conclusion of the study is that a large proportion of Canadian native pupils of early school age have the general intellectual potential necessary to participate fully in the larger Canadian community. It is also suggested that nonverbal stimuli be used more often as a media of instruction when working with native Canadian pupils. Six psychosocial influences likely to affect development of cognitive abilities in different cultures are identified and discussed: (1) achievement motivation; (2) immediate versus delayed gratification orientation; (3) initiative and curiosity behavior; (4) conceptual stimuli experience; (5) language; and (6) health and nutrition factors. (EV)

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Educational Potential of Northern Canadian Native Pupils

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(Paper presented at 19th Alaskan Science Conference, American Association for the Advancement of Science, Whitehorse, Canada, August, 1968.)

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1. Introduction

This paper will outline a model of the nature and development of intellectual abilities, present some evidence of both general intellectual potential and differential abilities of Eskimo and Indian-Metis pupils of the Mackenzie District in relation to their White classmates, and consider six psychosocial influences likely to affect development of various cognitive abilities in different cultures.

Abilities may be conceptualized as if organized in a hierarchy from relatively specific abilities at the bottom to general intellectual ability (g) at the top. Just below g are two main group factors, the verbal-educational group (v:ed) and the spatial-mechanical group (k:m). Each of these may in turn be viewed as encompassing several more nearly specific factors, and so on. Vernon (1965) has diagrammed this conceptual model for adolescent and young adult whites. The development of these abilities takes place through a sort of cumulative transfer as innate predispositions interact with environmental conditions. Since environmental conditions may differ considerably from one culture to another, so may the patterning and nature of abilities at all levels of the hierarchy.

2. Intellectual Abilities

2.1 General Intellectual Potential

2.1.1 Examples of tests. Table 2 lists some of the group tests we have used to assess intellectual abilities; the first eight listed use designs and geometric figures (and sometimes numbers) as stimuli, while the remainder are more usual school-like tests.

2.1.2 Samples. Data will be reported here for two groups of samples. The Mackenzie Norming Sample consisted of 792 Indian-Metis, 510 Eskimos, and 709 Whites who were

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representative of pupils attending Grades 1 to 8 of the schools of the Mackenzie District. Particular reference will be made to more extensive study of Eskimos and Whites at Inuvik and Tuktoyaktuk, and Indian-Metis at Faust, Alberta, in age 9 to 12 and 12½ to 15½ samples, as described in Table 1.

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Insert Table 1 about here

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2.1.3 Validity as measures of general intellectual potential. In Table 2 the column headed "Unrotated 1st Factors" indicates that all of the measures of that table, including the first-listed tests like Progressive Matrices which use nonverbal stimuli, are for these two Eskimo samples highly loaded on the same general intellectual ability factor that runs through traditional school-like abilities considered basic to our technological society. Similar results were obtained for the other ethnic samples.

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Insert Table 2 about here

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There is considerable additional evidence for the validity of such tests as Progressive Matrices as measures of general intellectual potential; for the Tuktoyaktuk Grade 6 to 8 class, for example, Progressive Matrices correlated 0.72 with the teacher's ranking of the pupils for "brightness".

2.1.4 Norms. Such measures are of little practical use unless suitable norms are available. Mackenzie District Norming Project (MacArthur, 1965) presents age norms for Eskimo, Indian-Metis and Whites separately for several of these measures, based on samples of Grades 1 to 8 pupils representative of the Mackenzie District.

2.1.5 Overlap of ethnic groups in general ability. Table 3 shows percentiles from the Mackenzie Norming Project on Coloured Progressive Matrices for ages 7 and 9 years, and Standard Progressive Matrices for ages 11 and 13 years for Eskimos, Indian-Metis, and Whites. The 50th percentiles show that for all four age groups the average of Whites is higher (on this test constructed by Whites from a background of White concepts). But, for the 7- and 9-year olds, note the great overlap of the scores of native pupils

with scores of the Whites; of these young native pupils, as indicated by their 90th percentiles, many scored well above the average Whites. However, for the 11- and 13-year olds the overlap decreases considerably, with fewer than ten percent of native pupils scoring above the average Whites.

If the validity data presented here and elsewhere of Progressive Matrices as a measure of general intellectual ability for such pupils is accepted, one clear conclusion is that large proportions of Canadian native pupils of early school age have the general intellectual potential necessary to participate fully in the larger Canadian community.

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Insert Table 3 about here

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2.2 Differential Abilities

2.2.1 Factor patterns. Going back to Table 2, the promax oblique primary factor patterns of these ability measures indicate, for both Eskimo age 9 to 12 and 12½ to 15½ groups, two rather highly correlated common factors, a clear v:ed factor and one here labelled reasoning from nonverbal stimuli (but resembling a k:m factor). Very similar factor patterns were obtained for the Indian-Metis and the Whites, although with somewhat more differentiation of abilities (more common factors) for the latter.

2.2.2 Differential abilities relative to Whites. Table 4 shows the mean scores for each of the native samples expressed in T-score norms based on the younger White sample. In general, abilities least affected by differences in native and white backgrounds were those assessed by tests highly loaded on the reasoning-from-nonverbal stimuli factor, and those most affected were assessed by tests loaded on the v:ed factor. But spelling and word memory tests showed little bias against native pupils; this relatively low ethnic bias in verbal memory as contrasted with high ethnic bias in comprehension of reading and oral English suggests need for care on the part of teachers of native pupils lest mere reproduction of printed materials be misinterpreted as understanding of the materials.

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Insert Table 4 about here

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2.2.3 Relative decline with age. Using scores for all three ethnic groups expressed in T-score norms based on the young Whites, the White increase with age from the mean of the younger to the mean of the older group was compared with the corresponding increase for each native group, as shown in Table 5. As they grow older the native pupils slip steadily behind their white classmates in most educational abilities, but more in the v:ed loaded tests, with the exception of word memory, than in those loaded on the reasoning-from-nonverbal-stimuli factor.

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Insert Table 5 about here

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This suggests, if native youth are to more fully realize their potential to join in the larger community, more emphasis in the curricula of schools and other training institutions on written and oral comprehension and expression of English as subjects of instruction, and more use of nonverbal stimuli as media of instruction (both very costly procedures).

3. Psychosocial Influences

But as a youngster grows up what he does with his abilities, and how his abilities themselves further develop, depend upon interaction between him and the people around him – his school, his home, the adults about him, his playmates. However, in the delineation of the main dimensions of what might be called the psychosocial environment as it may influence abilities, and in evolving devices for assessing along these dimensions, much research needs to be done. In the interim, from research conducted in a number of parts of the world, the following six psychosocial variables may be suggested as among the most important in shaping the development of young people's abilities.

3.1 Achievement motivation. – the intellectual and vocational aspirations of and for the child, the range of appealling adult models with whom to identify. Intelligence

depends on the future as well as the past. And here it is most important that immediate goals be those close to immediate interests and appearing attainable, but whose attainment moves in the direction of wider horizons.

3.2 Planfulness. – immediate gratification of basic biological needs vs. internal controls for delayed gratification of reasoned aspirations; harsh or inconsistent discipline vs. permissive but impulse-controlled discipline; impulsive vs. rationale climate.

3.3 Initiative and curiosity. – emphasis on passive conformity, obedience, tradition, dependence vs. encouragement of active problem-solving, resourcefulness, initiative, field-independence.

3.4 Conceptual stimuli. – education of parents and siblings; opportunities for varied direct experience with the world and vicarious experience through books, radio, TV, etc.

3.5 Language. – lack of facility in language of instruction, debased home language and restricted language codes vs. elaborated language codes allowing fine discriminations in thought and language.

3.6 Health and nutrition. – debilitating diseases, malnutrition, sanitation and medical care.

It is in improving on such influences in their surroundings that we can help young people take advantage of the capabilities they do have.

4. Some Next Research Steps

But it must be stressed that the foregoing overview of psychosocial influences on cognitive development is very tentative and general. How these suggested dimensions and their sub-dimensions interrelate and pattern for particular peoples is little known; there is need for specific research on what particular psychosocial influences affect the development of what particular abilities, and for our particular native peoples. The focus of developmental, social, and psychometric psychology on this problem in any comprehensive way is as yet but in its infancy.

As a small step in this direction the writer is planning an investigation of the interaction of particular psychosocial influences with particular cognitive abilities for Eskimo in the Igloolik area of Canada, with replication in Upernavik in Greenland,

with Africans in Zambia, and with a reference group of Alberta Whites. This will be part of the International Biological Programme, which is a 50-nation 8-year research program, the Human Adaptability Section of which is concerned with study, using standard procedures so that data may be exchangeable on a world-wide basis, of the variety of stresses to which man is exposed and his capacity to adapt to these stresses. In the International Study of Eskimos, as part of IBP, Canadian scientists will study Eskimos at Igloolik near Baffin Island, American scientists will study Eskimos at Wainwright in Alaska, and Danish and French scientists will study groups of Eskimos in Greenland, each national team using standard IBP procedures in its data collection. The Canadian team plans studies in the fields of genetics, demography, epidemiology, anthropometry, nutrition, ecology, physiology, and psychology; ISE should throw considerably more light on the correlates of the development of various cognitive abilities.

5. Abstract

For a number of samples of Eskimo, Indian-Metis and White pupils ages 7 to 15 years who were attending schools in the Mackenzie District of the Northwest Territories, factor analytic and other data are reported concerning the degree of validity of several "culture-reduced" measures as ways of assessing the general intellectual ability factor that runs through traditional school-like abilities considered basic to our technological society. Norms for some of the tests have been produced for Eskimo, Indian, and White pupils. Evidence is presented that large proportions of native Canadian pupils of early school age have the general educational potential necessary to participate fully in the larger Canadian community.

Concerning more specialized educational abilities, the native pupils achieved better in nonverbal abilities and in verbal memory abilities, relative to their white classmates, than in written and oral English comprehension. As they grow older, the native pupils slip steadily behind their white classmates in most educational abilities, especially those of a verbal comprehension nature. This suggests, if native youth are to more fully realize their potential to join in the larger community, more emphasis on written and oral comprehension and expression of English as subjects of instruction,

and more use of nonverbal stimuli as media of instruction.

Six psychosocial variables likely to affect the development of various cognitive abilities in different cultures are considered, and some next steps for basic research in this connection are outlined. Reference is made to the International Study of Eskimos now under way as part of the International Biological Programme.

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Table 1

Some Descriptive Data for Six Samples

		EskY	EskM	WhY	WhM	IMY	IMM
N		87	80	33	30	56	54
Age	Mean	10-9	13-8	10-3	13-6	10-7	13-10
	Range	8-6 to 12-2	12-3 to 15-8	8-6 to 12-2	12-3 to 15-8	8-9 to 12-2	12-4 to 15-5
Sex	Male	61	36	20	18	31	28
	Female	26	44	13	12	25	26
Grade	Mean	3.3	5.4	4.3	7.4	3.9	6.5
	Range	1 to 6	2 to 8	3 to 5	5 to 8	2 to 6	3 to 8
SES	Mean	38	38	53	52	39	38
	Range	30 to 57	30 to 60	32 to 65	32 to 75	30 to 57	30 to 57
No. in Hostel		37	41	1	1	0	0

Note. -- Of the Eskimo samples, about 40% spoke Eskimo in their homes most or all of the time, while 54% did so a small part of the time. Of the Indian-Metis samples, about 41% spoke Cree in their homes most or all of the time, while 48% did so a small part of the time. Of the White samples, 80% used English in their homes all of the time, while 20% used another language a small part of the time. Socioeconomic status was as assessed on the Blishen Scale, which for all of Canada has a mean of 50 and a standard deviation of 10.

Table 2

Factor Patterns, Eskimo Age 9 to 12 and Eskimo Age 12 1/2 to 15 1/2
(Factor coefficients below .3 omitted)

Tests	Unrotated 1st Factors		Promax Oblique Primary Factor Patterns							
			EskY			2	EskM			2
	EskY	EskM	I v:ed	II Reas. NVS	h		I v:ed	II Reas. NVS	h	
1. Embedded Figures (Vernon)	.66	.76		.86	.66			.60	.64	
2. Progressive Matrices Std.	.67	.79		.99	.77			.68	.71	
3. SCRIT Scale 1	.57	.51		.76	.49			.85	.56	
4. MAC 2	.60	.49	.33	.34	.36			.66	.39	
5. Lorge-Th.Lvl.3 NV 1	.66	.60		.63	.52			.50	.41	
6. Lorge-Th.Lvl.3 NV 2	.83	.83	.33	.61	.74		.45	.48	.70	
7. Lorge-Th.Lvl.3 NV 3	.74	.68		.80	.70			.74	.61	
8. IPAT Test of g Scale 2	.73	.47		.85	.72		-.34	.95	.63	
9. Letter & Number Induction	.81	.85	.40	.50	.67		.53	.42	.72	
10. Word Memory, Written	.58	.40	.70		.41			.44	.22	
11. Otis Mental Ability Beta	.75	.86	.84		.65		.78		.77	
12. Vocabulary, Written	.81	.74	.89		.75		.97		.74	
13. Arithmetic	.91	.89	.88		.89		.78		.81	
14. Reading Comprehension	.82	.77	.91		.78		.80		.66	
15. English Usage, Written	.88	.83	.86		.82		.96		.82	
16. Spelling	.80	.83	.92		.75		.91		.79	
17. Information Memory, Oral	.82	.73	.77		.70		.80		.61	
18. Grade	.89	.86	.94		.88		.90		.82	
Proportions of Total Variance	.58	.53	.39							
			.02	.27			.38			
							.02	.25		
					.68				.65	
Correlations of Oblique Primary Factors			I	II			I	II		
I v:ed			-				-			
II Reasoning from Nonverbal Stimuli			.65	--			.61	--		

Table 3

Percentiles for Three Ethnic Samples on Progressive Matrices

Mackenzie Norming Sample

Age	Eskimos			Indian-Metis			Whites		
	90th	50th	10th	90th	50th	10th	90th	50th	10th
7	25	18	13	25	16	9	29	20	14
9	31	22	14	31	21	15	33	26	18
11	38	26	14	38	28	14	49	42	26
13	45	35	18	44	35	22	52	44	27

Table 4

Mean T-scores Based on Whites Age 9 to 12

(Sample WhY Means are 50, S.D. 10, for each test.)

Test	Sample				
	EskY	EskM	WhY	IMY	IMM
Embedded Figures	47	55	50	43	51
Word Memory, Written	46	57	50	--	--
Spelling	47	53	50	--	--
Progressive Matrices Std.	44	51	50	40	48
Lorge-Th.Lvl 3 NV1	46	52	50	39	46
MAC 2	43	52	50	40	50
Letter and Number Induction	45	50	50	40	45
IPAT Test of g Scale 2	44	48	50	36	47
Lorge-Th.Lvl.3 NV2	43	49	50	37	44
SCRIT Scale 1	42	48	50	37	43
Information Memory, Oral	42	46	50	42	46
Lorge-Th.Lvl.3 NV3	41	48	50	33	43
Arithmetic	41	52	50	--	--
English Usage, Written	42	47	50	--	--
Vocabulary, Written	41	44	50	--	--
Otis Mental Ability Beta	41	44	50	--	--
Reading Comprehension	39	44	50	--	--

Note. -- Within groups, a difference of 2 may be considered significant at the .05 level, very approximately.

TABLE 5

Native Decrease in Ability Means with Age, Relative to Whites

Test	Eskimo			Indian-Metis		
	White Increase with Age less Eskimo Increase	z	p[a]	White Increase with Age less I-M Increase	z	p[a]
Vocabulary, Written	7.1	2.76	.01			
Otis Mental Ability Beta	6.4	2.71	.01			
Arithmetic	6.6	2.32	.02			
Spelling	5.2	1.90	.06			
English Usage, Written	4.2	1.72	.09			
Reading Comprehension	3.3	1.42	.16			
Information Memory, Oral	2.7	1.22	.22	1.8	.78	.44
Progressive Matrices Std.	3.1	1.14	.25	2.1	.75	.45
Lorge-Th. Lvl. 3 NV 1	2.6	0.87	.38	1.4	.47	.64
IPAT Test of g Scale 2	2.0	0.67	.50	-4.4	-1.47	.14
Embedded Figures (Vernon)	1.5	0.52	.60	1.8	.62	.54
Letter & Number Induction	1.2	0.50	.62	1.5	.60	.55
Lorge-Th. Lvl. 3 NV 3	0.3	0.11	.91	-2.6	-.93	.35
Lorge-Th. Lvl. 3 NV 2	-0.5	-0.20	.84	-1.7	-.68	.50
Word Memory, Written	-1.0	-0.37	.71			
SCRIT Scale 2	-1.6	-0.49	.62	-2.2	-.66	.51
MAC 2	-1.9	-0.64	.52	-3.3	-1.09	.28

Note. — [a] Each p is in effect the two-tailed probability of an uncorrelated difference of an uncorrelated difference.